Demand for Imports under Planning
Some Theoretical Considerations
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THE purpose of this paper is to provide a methodological framework for the estimation of import and pari passu foreign exchange requirements under planned economic expansion. Any effective system of control on imports must necessarily hinge on an awareness and proper appraisal of the pressures that may arise in the economy under planning.

The influence of relative prices on the demand for commodities (finished or intermediate, domestic or imported) has been recognised since the early days of neo-classical economic thinking. So long as there is enough scope for substitutability between goods, either in consumers' preferences or producers' techniques, dearer items will in general be replaced by cheaper ones. With suitable modifications, relative prices will have its role in the determination of the demand for imports. Foreign exchange requirements will be governed principally by the elasticities of demand for home goods vis-a-vis foreign goods, as well as by their elasticities of supply. Supply considerations will play a more prominent part in the long run than in the short run. The preoccupation of neo-classical economists with allocation problems and their tacit assumption of full employment make their theoretical structure suited to the study of changes in the demand for imports relative to home goods through the mechanism of change in relative prices (as a result of shifts in the basic parameters of the system or deviations from the full employment equilibrium).

Keynesian Formulation

With the advent of Keynesian economics, we find the scale swinging in favour of hitherto neglected income as a major determinant of imports. The aggregative Keynesian analysis relegates relative prices to the background, recognises the possibility of underemployment equilibrium and highlights the role of income in the determination of consumption, imports and exports and even investment (induced). To avoid digression, the following proposition is immediately stated: both imports (as well as consumption) and in-

come are simultaneously determined, given investment and exports as exogenous variables (neglecting government as a matter of simplification), and the two relations expressing consumption and imports individually as functions of income. Denoting by Y, C, M, E and I income, consumption, imports, exports and investment respectively, we observe that by definition, $Y = C + I + E - M$. Writing consumption function as $C = C(Y)$ and import function as $M = M(Y)$, we can solve for a given level of investment

$(\bar{I})$ and exports $(\bar{E})$. Thus $\bar{Y} = (\bar{I} + \bar{E})/[1 - dC/dY + dM/dY]$ and $\bar{M} = M(\bar{Y})$ where the magnitudes dC/dY and dM/dY are known as marginal propensity to consume (i e, increment of consumption per unit increment of income) and marginal propensity to import (i e, increment of imports per unit increase in income) respectively. Thus we first solve for equilibrium income and then feed this income into the import function to obtain aggregate imports. We can remove the stigma of exogeneity from exports and convert it into an endogenous variable by relating it functionally to other countries' incomes. In this case we require a simultaneous system, consisting at least of two countries 1 and 2 (say the country under consideration and the rest of the world), each having its income and equation to determine income, consumption, import and export of the two countries in terms of the exogenous variables, investment of 1 and 2 and the four marginal propensities. The logic of this procedure is not difficult to follow. A change in income of country 1 is likely to affect its imports and hence country 2's exports. A change in country 2's exports, on the other hand, will affect its income and as a result, its demand for imports from country 1; thus there is a sort of feedback effect which may be quantitatively significant if country 1's exports are large and sensitive to fluctuations abroad. All this appears like a vicious circle but turns out in effect to be virtuous, the sys-

tem being solvable as indicated above.

Extensions of the Keynesian Formulation

The above presentation is undoubtedly too simple to have much usefulness in practice. Nevertheless, as a theoretical model, it gives us an insight into the process which relates and determines national income and imports. The invariance of any parameter expressing imports as a simple function of income is rather a shaky hypothesis to start with in an empirical formulation and we cannot help going beyond the grand facade of Keynesian aggregates and probe into their components for a more satisfactory analysis. We are concerned here mainly with imports, which consist of both consumption goods and producers' goods.—raw materials and capital equipment. Consumption out of imports may very well be regarded as a function of income (along with domestic consumption) and the term 'propensity' which connotes a behaviour relation is probably justified in this case. But in the case of producers' goods, the demand for imports is likely to be guided by the technical requirements of domestic production which cannot be regarded as a simple function of income with stable structural parameters. Thus the standard notion of marginal propensity to imports which smacks of some sort of behaviour relation as in the case of consumption function ill fits into an empirical construction.

However, one can proceed on Keynesian lines and deal basically in aggregates with a minimum amount of necessary breakdowns. Neisser and Modigliani in their voluminous work* on the quantitative aspects of international trade consider imports as a function of income, prices, net stock change, net capital inflow and food production in the case of

* H Neisser and F Modigliani, National Incomes and International Trade—a Quantitative Analysis, Urbana, 1953. See also, for empirical study on Keynesian lines. J J Polak, An International Economic System, London, 1954.

industrial countries, while for non-industrial countries the major determinants are taken to be exports plus industrial output, prices, net stock change and net capital inflow. For both industrial and non-industrial countries, they split up imports into raw materials, food and manufactured goods. Exports of any country, on the other hand, are assumed to depend on imports of all other countries, prices, net stock-change and net capital flow. Structural parameters are estimated by means of multiple regression from time series data. The Neisser-Modigliani system consists of two endogenous variables, imports and exports which are expressible in terms of five exogenous variables, income, prices, net stock-change, net capital flow and food production. It is admitted that income may not properly be regarded as an exogenous variable as it is affected directly by changes in trade balance. It may also be pointed out that in a more comprehensive system, the exogenous variables mentioned above would have to be replaced by relationships involving more basic magnitudes.

Input-output method:

An Alternative Formulation

It appears that the above approach, while it may serve as a fairly satisfactory explanation of the behaviour of foreign trade for the periods covered for the estimation of structural parameters, may be an extremely inadequate guide for countries going through a process of planned economic development. For economic development implies basic structural changes, requiring heavy initial investment and gradually resulting in altered product composition. The invariance of structural parameters based on time series data is likely to have more validity in systems which have attained some degree of structural stability. These considerations lead one to believe that instead of postulating relationships between aggregates, a disaggregative model articulating the more proximate and less remote relationships within the system may serve as a better guide for planning.

Before developing such a model, some general considerations are in order. We shall find that the estimation of import requirements is just a by-product of our more comprehensive framework.

Planning in underdeveloped countries requires in the initial stages heavy investment expenditure with a rather high foreign exchange component, particularly in the form of machineries which have to be imported from abroad. Quite apart from this, increase in investment will be revealed in the placing of large orders with the domestic sectors of the economy. Home industries in turn require raw materials, some of which may have to be imported. The indigenous raw materials, on the other hand, have to be produced and may require as their inputs specialised imports not available at home. Thus we have a whole chain of demand for inputs, requiring possibly at every stage some amount of imported materials of different kinds.

Apart from increased investment expenditure, raising of production targets in different sectors of the economy will generate a series of demand for inputs some of which have to be met by imports. It is the induced, rather than the direct effects of planned expansion on import requirements which are likely to elude any ad hoc estimation of foreign exchange needs of the country.

There is another important factor, namely capacity limitations in different branches of the economy, which have a kind of different bearing on import demand under expansion. The sectors where investments are being made will have increased capacity, though only after a time lag depending on the period of gestation of the projects under consideration. Production targets fixed arbitrarily without a proper appreciation of the interdependencies within the economy, may generate demand on those sectors which do not have enough excess capacity, at the same time leaving unutilised capacity in some other sectors. Capacity bottlenecks can be remedied in the long run by increased investment. The short run solution lies in importing materials, which though producible at home cannot be made immediately available in view of the limits set by inadequate capacity.

A comprehensive system which articulates these various considerations in an integrated framework is provided by Professor Leontief's

input-output method.[†] We start with a basic definitional identity, which states that total domestic output (gross) in any sector of the economy in a given period is exhaustively allocated as current inputs to different sectors and as final goods for private consumption by households, government consumption, exports and capital formation (public and private including net change in stock). Depending on the technique of production, it may be quite realistic to assume that different types of inputs required per unit of any product are constant. Changes in technique will be revealed in changes in input-output coefficients. The domestic sectors also consume as inputs imported raw materials, some of which are of a specialised variety and some non-specialised but in short supply at home. Allowing for possible import substitution depending on the investment programme, we may work out the import coefficient per unit of product in different branches of the economy.

Import Coefficient per unit of

Product

Suppose there are n sectors in the economy; let us denote by $x(i) = $ total output of the ith product, $x(ij) = $ amount of ith product used as current input in the jth industry, $c(i) = $ private consumption of the ith product, $g(i) = $ government consumption of the ith product, $f(i) = $ capital formation out of ith product, $e(i) = $ amount of ith product exported, $a(ij) = x(ij)/x(j) = $ amount of ith product required per unit of the jth product, $m(j) = $ import requirements (of all kinds) per unit of the jth product. The magnitudes may be recorded in terms of money values. We have the accounting identity:

$$x(i) = x(i1) + x(i2) + \ldots + x(in) + y(i)$$

where

$$y(i) = c(i) + g(i) + e(i) + f(i) \text{ for } i = 1,2, \ldots, n.$$

From the assumption of fixity of production coefficients, we obtain for $i = 1,2, \ldots, n$,

$$a(i1)x(1) + a(i2)x(2) + \ldots + (1 - a(ii))x(i) + \ldots + a(in)x(n) = y(i)$$

If targets are fixed in terms of the availability for final uses, i e, in

† W Leontief, The Structure of American Economy, New York, 1951.

terms of the final bill of goods $y(i)$, we can solve for the total output required from different sectors of the economy. It must be noted that each of the categories in the final uses must be taken net of imports, since the induced inter-sectoral requirements will originate from the needs of domestic production. Once we obtain $x(1)$, $x(2)$, . ., $x(n)$, given a target set of final bill of goods, y (1), $y(2)$, . . ., $y(n)$, we are in a position to estimate the indirect import requirements (i e, those which are distinct from imports which directly enter into final uses) by multiplying the output requirements in different sectors of the economy by their corresponding import coefficients. Clearly, indirect import requirements amount to $m(1)x(1)+m(2)x(2)+\ldots+m(n)$ $x(n)$. This added to the import content of the final bill of goods gives us the aggregate import demand originating from the planned targets of the economy as a whole.

Capacity Limitations

The above analysis is based on the tacit assumption that there is enough capacity in the economy to meet the direct and induced (for intermediate uses) needs of the domestic component of the final bill of goods. If capacity is exhausted in any sector of the economy and if the pressure on that sector is likely to be a continual one and not of an once-for-all type, solution in the long run will lie in additional capital formation. Provision for this in the investment programme of the plan need not necessarily wipe out the bottleneck, for the lag between the time when the pressure on that sector originates and the time investment starts yielding fruits may be a significantly long one. In any case, there remains the short-run problem of alleviating the immediate needs. We find here a situation where the demand for materials has to be met directly by imports because of inadequate capacity in domestic sectors.

It follows, therefore, that the above method will fail if the solutions for output requirements from our system of simultaneous equations are found to exceed capacity in one or more branches of the economy.* For no induced demand for raw materials will emanate

from the sectors which have run out of capacity. One way to account of this possibility by following the iterative method of solution in input-output analysis. Starting with the planned bill of goods, we work out the requirements from different sectors of the economy by applying the input-output coefficients. We consider our results as another configuration of final demand and work out the demands they will generate; the same procedure is followed in successive rounds. As soon as capacity limit is reached in any sector of the economy, induced demand from that sector will cease to be wholly replaced by imports. We may work out the necessary number of iterations (depending on the accuracy required) and obtain our solutions for domestic and import requirements.

Propensity to Import

The Keynesian propensity to import will come into its own in the estimation of the consumption component in the final bill of goods. All other import requirements will be governed by the technicalities of domestic production and the nature of investment projects. In the input-output scheme, depending on the degree of disaggregation, we obtain not only the aggregate of induced imports, but also their composition. Evidently the overall magnitude and breakdown of imports will depend on the composition of plan targets. This factor is not explicitly accounted for in the Keynesian aggregative formulation. One is inclined to believe that structural parameters obtained from time series data involving lumped variables are not likely to hold, when new institutional considerations in the wake of planning are introduced in the economy. It is indeed here that the input-output approach allows us a certain degree of flexibility and maneuverability.

Adjustment for Price Changes

Solutions based on input-output coefficients derived from value data (interpreted as rupee-worth of input per rupee-worth of output) re-

* Clearly capacity has a time dimension. If the plan is spread out over a longer period, then capacity bottleneck need not arise, requirements being met by supply from domestic sources, obviating the need for imports.

quire adjustment in case of any changes in prices. It is easy to make allowance for anticipated changes, though not for unforeseen contingencies. To be on the safe side, one may work out a maximum and a minimum to import requirements in terms of quantities of various products as well as their values. For, in the case of agricultural commodities, in particular, the notion of capacity may be a bad guide as extraneous factors like rainfall, temperature, etc, play a dominant role in ill irrigated underdeveloped areas. It is to be hoped that with increasing irrigation facilities and, far-reaching changes in agricultural techniques, fluctuations caused by natural factors will come to be confined within narrower limits, and the margin of error in our estimation of import demand will be correspondingly reduced.

It is quite appropriate that we should distinguish between the two main components of imports, consumption goods and producers' goods. For while consumption of luxury goods may be drastically controlled, and if necessary, prohibited, imports of raw materials and capital equipment will have to be provided for the realisation of the basic plan targets.

While the Keynesian method requires data on the basic variables spread over a sufficiently long period of time, what we need for input-output analysis is a much wider coverage, not in time but in space covering the different sectors of the economy. It is supposed that choice regarding techniques has already been made and for the techniques chosen we are required to find the input-output ratios which may be regarded sufficiently reliable.†

To avoid being dogmatic, I would suggest that for a study of import demand, we could proceed along both the lines and test for the efficacy of alternative formulations. The two methods are not by any means competitive. There is much to say in favour of input-output approach as a planning device and in this, it serves a much wider purpose than just the estimation of import demand.

† Choice regarding techniques is relevant to new industries, improvements or replacements.